REMARKS/ARGUMENTS

Favorable reconsideration is requested in view of the above amendments and the following remarks.

Information Disclosure Statement

The Office Action points out that the references contained on lines 19-32 of page 1 are not included in Form PTO-1449 and have therefore not been considered. These references are not deemed to be relevant to the patentability of the invention and therefore do not need to be considered. The acknowledgment that US Patent 5,243,444 has been considered is noted with appreciation. The Examiner is requested to confirm that PTO-1449 filed May 22, 2000 has been initialed with respect to this reference, so that it will appear in the listing of cited references on the face of the patent.

Claim Rejections - 35 USC §112

Claims 1-22 have been rejected under 35 USC §112, first paragraph, as allegedly failing to comply with the enablement requirement.

MPEP Section 2164.01, describes the "Test of Enablement" as:

> Any analysis of whether a particular claim is supported by the disclosure in an application requires a determination of whether that disclosure, when filed, contained sufficient information regarding the subject matter of the claims as to enable one skilled in the pertinent art to make and use the claimed invention. The standard for determining whether the specification meets the enablement requirement was cast in the Supreme Court decision of Mineral Separation v. Hyde, 242 U.S. 261, 270 (1916) which postured the question: is the experimentation needed to practice the invention undue or unreasonable?

Additionally, the section goes on to explain that "A patent need not teach, and preferably omits, what is well known in the art."

In particular, with respect to Claims 1 and 22, the Office Action states that there is no enablement of "obtaining for each individual pixel a continuous value as a weighted sum". However, Applicants disagree and wish to point out that this feature is described in enabling detail in the specification. Page 6, line 27 presents the equation:

$$y^{m+1}(i,j) = \sum_{(k,l)\in Nm+1(i,j)} a_{ij}{}^{m+1}(k,l)y^m(i+k,j+l),\ \ m=0,1,2,\ldots,(M-1).$$

In this equation the individual pixel values are represented by "$y^{m+1}(i,j)$" and the equation clearly shows to anyone skilled in the art how the values are obtained using a weighted sum. The weighting is given by the "significance coefficient" term "$a_{ij}{}^{m+1}(k,l)$". The meaning of "continuous value" is clearly defined at page 4, lines 20-26 of the specification. A written "program code" (i.e. computer language) in the specification is not required to meet the enablement requirement, as one skilled in the art could easily program the above equation into a computer to implement "obtaining for each individual pixel a continuous value as a weighted sum" with no experimentation.

The Office Action also states that there is no enablement for the "significance coefficient". However, Applicants disagree and wish to point out that this feature is disclosed in an enabling manner in the specification. Page 7, line 20 presents the equation:

$$a_{ij}{}^{m+1}(k,l)= f^{m+1}(y^m(i+k,j+l) - w^m(i,j))$$

As explained at page 2, lines 20-22, the "coefficient ('significance coefficient') is defined indicating the likelihood that that nearby pixel is correlated with the given pixel". As explained at page 7, lines 6-8, "if the two pixels are of different objects, the value of z for the two pixels may be uncorrelated". All the terms of the equation are

adequately described in the specification so that one skilled in the art could easily program the above equation into a computer to implement the "significance coefficient".

Determining y^m (i+k,j+l) is adequately described in the specification. The first value of y^m (i+k,j+l) at m=0 is just "x" (page 7, line 29). The values for y^m (i+k,j+l) at subsequent iterations of "m" are then computed based on the values determined from previous iterations.

Determining w^m(i,j) is also adequately described in the specification. The values for w^m(i,j) are determined by subjecting y^m to low pass filtering (see page 7, lines 13-14). Low pass filtering is well known, as evidenced from US 5,506,699, which was cited against Applicants' application.

The function $f^{m+1}(v)$ is described as a mapping function (page 7, line 22) and an example of an exact equation for "f" is given by $f(i) = (1\text{-}i/255)^k$ (see page 9, line 13).

Therefore, the specification provides enabling disclosure for the "significance coefficient" term "$a_{ij}{}^{m+1}(k,l)$".

The Office Action also states that "the best mode of implementing said algorithm(s) and program code(s) is not adequately specified".

The "Best Mode Requirement" is described in MPEP Section 2165 as:

> First, it must be determined whether, at the time the application was filed, the inventor possessed a best mode for practicing the invention. This is a subjective inquiry which focuses on the inventor's state of mind at the time of filing. Second, if the inventor did possess a best mode, it must be determined whether the written description disclosed the best mode such that a person skilled in the art could practice it. This is an objective inquiry, focusing on the scope of the claimed invention and the level of skill in the art. Eli Lilly & Co. v. Barr Laboratories Inc., 251 F.3d 955, 963, 58 USPQ2d 1865, 1874 (Fed. Cir. 2001).

MPEP Section 2165 goes on to instruct that the Examiner should "assume best mode is disclosed unless there is evidence to the contrary". It explains:

> The examiner should assume that the best mode is disclosed in the application, unless evidence is presented that is inconsistent with that assumption. It is extremely rare that a best mode rejection properly would be made in ex parte prosecution. The information that is necessary to form the basis for a rejection based on the failure to set forth the best mode is rarely accessible to the examiner, but is generally uncovered during discovery procedures in interference, litigation, or other inter partes proceedings.

Applicants wish to point out that the disclosure of a written "program code" in the specification is not required to satisfy the "best mode" requirement. The features of "obtaining for each individual pixel a continuous value as a weighted sum" and the "significance coefficient" of the claimed invention could easily be implemented using routine skill to write a "program code" implementation of the disclosed algorithms. Please note the court case In re Sherwood, 613 F.2d 809, 204 USPQ 537 (CCPA 1980) where the inventor had more information in his possession concerning the contemplated best mode than was disclosed (a known computer program). Importantly, the specification was held to delineate the best mode in a manner sufficient to require only the application of routine skill to produce a workable digital computer program. Applicants' written description already discloses the best mode of the claimed invention such that a person skilled in the art could practice it. Also, the inventor knows of no better mode for practicing the invention.

The Office Action also rejects Claim 3, stating that neither the claim nor the specification disclose how or in what manner the significance coefficient performs the function of "said significance coefficient of each neighborhood pixel is an indication of the likelihood that the value of that neighborhood pixel in the original image is correlated with the value of the individual pixel in the original image."

However, Applicants' specification provides enabling disclosure for this feature. As explained above, the significance coefficient, "$a_{ij}{}^{m+1}(k,l)$", is enabled and includes the term "$y^m(i+k,j+l) - w^m(i,j)$". This term is a measure of the likelihood that a pixel value at (i+k,j+l) is uncorrelated with the pixel value at (i, j) (see page 7, lines 16-17). Also, note that "$y^m(i+k,j+l)$" is used to represent neighborhood pixels of the original image since the best estimate of the value of the original pixels z(i, j) is provided by "$y^m(i,j)$" (see page 7, lines 9-10).

The Office Action also rejects Claim 7, stating that "non-linear function" used to describe f(v) is a very broad term that can potentially cover many functions and function types. It would therefore not be capable of implementation without extensive trial and error. However, this claim is enabled and a specific enabling example of the non-linear function f(v) is provided at page 9, line 13 as $f(i) = (1-i/255)^k$, for k=12 or k=14.

Claim 10 has been canceled, rendering the rejection of Claim 10 moot.

The Office Action also rejects Claims 11 and 12, stating that the specification fails to disclose any details pertaining to "forming an enhanced reconstructed image as a linear combination of said reconstructed image and a continuous image derived from said halftone image by a second image reconstruction method". These claims are completely enabled by the equation for the inverse halftone pixel values "$y^{m+1}(i,j)$" and the equation for the significance coefficients "$a_{ij}{}^{m+1}(k,l)$" set forth at page 6, line 27 and page 7, line 20, respectively, and described by the accompanying text of the specification. These equations are readily understood by, and can easily programmed by, one skilled in the art. Once again these equations are:

$$y^{m+1}(i,j) = \sum_{(k,l)\in Nm+1(i,j)} a_{ij}{}^{m+1}(k,l)y^m(i+k,j+l), \quad m=0,1,2,\ldots,(M-1) \text{ and}$$

$a_{ij}^{m+1}(k,l) = f^{m+1}(y^m(i+k,j+l) - w^m(i,j))$

The "enhanced reconstructed image" of Claim 11 is formed from the pixels $y^{m+1}(i,j)$. The "continuous image derived from said halftone image by a second image reconstruction method" is the term "$w^m(i,j)$" which, as described at page 7, lines 11-15, can be determined by subjecting y^m to a low pass filter, an operation well known in the art.

The Office Action also rejects Claim 22, stating that the "image enhancement apparatus" is not disclosed in or enabled by the specification. However, the apparatus is described at page 5, lines 10-14 of the specification. As explained above, one skilled in the art can implement the invention using a computer with out any experimentation.

The Office Action rejects Claims 2, 13 and 14. Applicants wish to thank the Examiner for his valuable suggestion and have amended these claims to read "a reconstructed image which for each of said pixels takes <u>on one of</u> more than two <u>possible</u> values" so that these claims are now definite.

<u>Claim Rejections - 35 USC 102</u>

Claims 1-8 and 12-22 have been rejected under 35 USC 102(b) as being anticipated by Wong (US 5,505,699). However, Wong does not show the following features of the independent Claims 1, 2, 13, 14, 16, 17 and 22:

Claim 1: "obtaining for each individual pixel a continuous value by summing the products of the weighting values and the continuous values of the pixels in the neighborhood of the individual pixel obtained at the previous iteration, the weighting

values being derived from the continuous values obtained in at least one previous said iteration";

Claim 2: "deriving the reconstructed value of the individual pixel as a sum over the pixels of the neighborhood of a product of the halftone image value at that neighborhood pixel with the significance coefficient of that neighborhood pixel";

Claim 13: "deriving an (m+1)-th reconstructed value of the individual pixel as a sum over the neighborhood pixels of the product of the m-th reconstructed value at that neighborhood pixel with the significance coefficient of that neighborhood pixel";

Claim 14: "deriving the reconstructed value of the individual pixel as a sum over the pixels of the neighborhood of a product of the preprocessed image value at that neighborhood pixel with the significance coefficient of that neighborhood pixel";

Claim 16: "deriving the reconstructed value of the individual pixel as a sum over the pixels of the neighborhood of a product of the first value at that neighborhood pixel with the significance coefficient of that neighborhood pixel";

Claim 17: "deriving the reconstructed value of the individual pixel as a sum over the pixels of the neighborhood of a product of the preprocessed image value at that neighborhood pixel with the significance coefficient of that neighborhood pixel"; and

Claim 22: "obtaining for each individual pixel a continuous value by summing the products of the weighting values and the continuous values of the pixels in the neighborhood of the individual pixel obtained at the previous iteration, the weighting values being derived from the continuous values obtained in at least one previous said iteration".

All of these independent claims include the feature of:

1) calculating the products of the weighting values/significance coefficients multiplied with the values of the neighborhood pixels,

and then

2) summing the resulting products.

This feature is illustrated by the equation at pages 6-7 of Applicants' specification:

$$y^{m+1}(i,j) = \Sigma_{(k,l)\in Nm+1(i,j)}\, a_{ij}{}^{m+1}(k,l)y^{m}(i+k,j+l),\quad m=0,1,2,\ldots,(M-1)$$

where

$$a_{ij}{}^{m+1}(k,l)= f^{m+1}(y^{m}(i+k,j+l) - w^{m}(i,j))$$

In the equation $a_{ij}{}^{m+1}(k,l)$ are the weighting values/significance coefficients and the values of the neighborhood pixels are represented by $y^{m+1}(i,j)$.

Wong determines the pixel values using the equation:

$$x_{m,n}^{new} = \begin{cases} \mu_{m,n} + \gamma v_{m,n} & if\ x_{m,n}^{old} > \mu_{m,n} + \gamma v_{m,n} \\ \mu_{m,n} - \gamma v_{m,n} & f\ x_{m,n}^{old} < \mu_{m,n} + \gamma v_{m,n} \\ x_{m,n}^{old} & otherwise \end{cases}$$

where

$$v_{m,n} = \left(\frac{1}{\|R_{m,n}\|} \sum_{(i,j)\in R_{m,n}} \left| x_{i,j}^{old} - \mu_{m,n} \right|^{r} \right)^{1/r}$$

The Office Action asserts that the significance coefficients of the present invention are the same as Wong's variables $v_{m,n}$. However, they are not the same and Wong does not disclose the above claimed features. It is true that that Wong's variables $v_{m,n}$ can be said to be "weighting values being derived from the continuous values obtained in at least one previous said iteration" as claimed in Claims 1 and

22. However, if Wong's variables $v_{m,n}$ are said to be the weighting values/significance coefficients of the present invention, there is no way to argue that $v_{m,n}$ is multiplied with the values of the neighborhood pixels and there is no summing of the resulting products as in the present invention.

In Wong's method, all the neighboring coefficients are treated in exactly the same way. In the computation of $\mu_{m,n}$, all values in the neighborhood are treated equally. In the computation of $v_{m,n}$, all values are treated equally (i.e. no special scaling is given any individual values).

On the other hand, in Applicants' invention, each of the neighboring coefficients $y^m(i+k,j+l)$ is scaled by a different scaling factor $a_{ij}{}^{m+1}(k,l)$. The determination of the scaling factor $a_{ij}{}^{m+1}(k,l)$ depends on $y^m(i+k,j+l)$, another value $w^m(i,j)$ and the non-linear function $f^{m+1}(.)$. Applicants' method has only one case (no if-statements), while Wong's method has 3 cases (two if-statements).

Additionally, Applicants' Claim 6 recites:

"the significance coefficient for each neighborhood pixel is a <u>decreasing function</u> f(v) of the absolute difference (v) between the halftone value at that neighborhood pixel and the baseline value for the individual pixel".

The Office Action asserts that Wong also uses a decreasing function at lines 44-58 of column 7 of Wong. Actually, the function in lines 44-58 of column 7

$$v_{m,n} = \left(\frac{1}{\left\| R_{m,n} \right\|} \sum_{(i,j)\in R_{m,n}} \left| x_{i,j}^{old} - \mu_{m,n} \right|^r \right)^{1/r}$$

is an increasing function and does not disclose the claimed feature. Note that x^r and $x^{1/r}$ are increasing functions of x, for any $r \neq 0$.

Applicants' invention provides high quality inverse-halftone images at low computational cost and is in no way anticipated by or obvious in view of Wong or any of the other prior art of record.

All the other claims depend from one of claims 1, 2, 13, 14, 16, 17 and 22, and are therefore also not anticipated by or obvious in view of Wong or any of the other prior art of record.

Conclusion

It is submitted that the application is now in condition for allowance, and a notice to that effect is respectfully solicited.

Respectfully submitted,

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